

This catalogue has recently been published, so a few words about the method employed in making the observations may be opportune. Before setting out on this journey Mr. Stanley Williams made several hundreds of observations to make himself familiar with this class of work, so that his estimations have considerable weight. He adopted the usual method of making variable star observations by using an opera-glass, and bringing each star and its comparison stars into the centre of the field consecutively. The star undergoing comparison was usually compared with two others of known magnitude, one of which was brighter and the other dimmer than the star to be observed. Instead, however, of estimating the difference of brightness between the comparison star and the star under examination in steps or grades, the magnitude of a step being usually different for nearly every observer, he employed another method. This was to mentally divide the interval between the two comparison stars into as many parts as there were tenths of a magnitude between them, the adopted magnitudes of the comparison stars being, of course, known, and then estimate how many of these tenths the star under observation was dimmer and brighter than the comparison stars.

A step in this case thus corresponded to a tenth of a magnitude on the scale of the "Harvard Photometry." A comparison of the resulting magnitudes of some of the stars observed, which have also appeared in the "Southern Meridian Photometry," shows that "the present catalogue, on the whole, accords exactly with the 'Harvard Photometry,' though the number of stars is too small for absolute certainty." A similar comparison with the "Uranometria Argentina" shows more considerable differences, excepting between 2.8 and 3.4 magnitudes; but it must be remembered that the scale of the "Uranometria Argentina" differs largely from that of the "Harvard Photometry."

In the course of this work one variable, V Puppis, was discovered, and thirteen other stars were found to be probably variable.

THE VARIABLES S CASSIOPEIÆ AND S URSÆ MAJORIS.—Some time ago, in this column (December 2, 1897, p. 105), we had the pleasure of saying a few words about the variable stars S Cephei and T Ursæ Majoris, which Mr. Peek, of the Rousdon Observatory, had so energetically observed and recorded during the years 1887 to 1896. We are now able to refer our readers to another small, valuable pamphlet (No. 3) containing the observations, extending over the same years, of the two variable stars S Cassiopeiæ and S Ursæ Majoris. Each of the observations here recorded is the mean of five visual comparisons with stars whose magnitudes have been previously determined either by Mr. Peek himself or some other observer. Further, the comparisons are all made with stars in the same field of view as the variable under observation, the instrument employed being a 6.4-inch equatorial refractor by Merz. The observations are recorded in a uniform way throughout, in which the date of observation, the magnitude, and remarks as to colour and magnifying power used are given. As in the previous publication, Mr. Peek adds a graphical study of the light changes of these stars throughout each year, and a perusal of these curves is of great interest. We hope Mr. Peek has some more observations of other variables which he will publish in like manner, as it is just such observations that will throw light on the changes which these stars undergo.

OCCULTATIONS PHOTOGRAPHICALLY OBSERVED.—Prof. E. C. Pickering records, in a Circular (No. 26) of the *Harvard College Observatory*, the result of the occultation of 26 Arietis as observed photographically at that observatory. The instrument used was an improved form of that constructed for photographing the eclipses of Jupiter's satellites, and previously described. The phenomenon of this occultation was satisfactorily photographed by Mr. Edward S. King on February 25 of this year. The apparatus was connected with a standard clock, and the photographic plate was moved about 0.03 cm. every time the circuit was closed or opened, two images alternately faint and bright being obtained every second, the duration of exposures being 0.06 and 0.94 seconds. An examination of the series of images showed that the time of occultation could be fixed to within one-tenth of a second. Prof. Pickering adds that by using shorter exposures the uncertainty of the time of disappearance can be still further greatly reduced, especially in the case of brighter stars. 26 Arietis is a star of magnitude 6.1; since satisfactory images were produced in 0.06 seconds, stars

probably down to the ninth magnitude can be thus photographically observed. The stellar images were further examined to inquire whether any lunar atmosphere could be detected by noting any change in the intensity of these images; but none was discovered. *A propos* of occultations, it is interesting to draw attention to the fact that Prof. G. P. Bond, more than forty years ago, took a number of photographs of the moon and a Virginis shortly before the occultation of the latter, to determine photographically the position of the moon.

COMET PERRINE.—A telegram from Kiel, dated March 21, informs us that the position of Perrine's Comet at 19h. 7m. Mount Hamilton mean time was R.A. 21h. 16m., and Declination 26° 44' north, the movement in these two coordinates being 14 and 37 seconds respectively.

A MAGNETIC STORM.

SINCE August 1894 no magnetic storm has occurred in England at all equal to one experienced during the last few days. Its first indication at Kew Observatory occurred about 8.55 p.m. on the 14th, when a noticeable increase took place in the horizontal force. This element then oscillated about its normal value to a moderate extent until 4 p.m. on the 15th, when there commenced a large decrease superposed on large oscillatory movements. The minimum was reached about 10.48 p.m. on the 15th. During the subsequent rise, which was very rapid at first, there were some further large oscillations, and the element remained somewhat disturbed until 5 p.m. on the 16th. The vertical force was only slightly disturbed until 2 p.m. on the 15th. After increasing to a maximum about 5 p.m. it decreased rapidly with large oscillations, attaining a minimum about 10.48 p.m. It then reapproached its normal value, the oscillations being large at first, but becoming small early in the morning of the 16th.

The declination disturbance commenced at the same time as that of the horizontal force, but was small until midnight on the 14th. After a general easterly movement, lasting for some hours, the needle reversed its direction, attaining its extreme westerly position about 2.48 p.m. on the 15th. It then recommenced a very conspicuous movement to the east, with various large oscillations. After attaining an extreme easterly position about 11.18 p.m. on the 15th, the needle moved once more to the west, the motion remaining oscillatory. The disturbance did not disappear until about 5 p.m. on the 16th.

The extreme amplitude of the disturbance was: horizontal force, '0050 C.G.S. units; vertical force, '0057 C.G.S. units; declination, 1° 26'. In eight minutes, from 10.40 to 10.48 p.m. on the 15th, the horizontal and vertical components exhibited falls of '002 and '003 C.G.S. units respectively. The most rapid change of declination occurred some thirty minutes later. Speaking generally, the most salient features were the large falls in both the horizontal and vertical components, and the movement of the declination needle to nearly 1° east of its normal position. The storm was presumably associated with the brilliant aurora visible on the night of the 15th in the northern half of the kingdom and in Denmark (*Daily Weather Report*, March 16).

CHARLES CHREE.

THE AUSTRALASIAN ASSOCIATION.

THE meeting of the Australasian Association for the Advancement of Science, held at Sydney in the beginning of January, appears to have been a very successful one. From the reports which came to hand a few days ago it appears that the meeting was attended by the foremost men of science in the various Australasian Colonies, and that a large number of papers were read in the different sections. The Association now numbers more than six hundred members.

The meeting was opened on Friday, January 6, and on the evening of that day Prof. Liversidge delivered his address as president of the Association. Saturday, January 7, and succeeding days in the following week were largely taken up with the sectional meetings. Papers were read in connection with astronomy, mathematics and physics; chemistry, geology and mineralogy, biology, geography, ethnology and anthropology, economic science and agriculture, engineering and architecture,

sanitary science and hygiene, mental science and education. Reports of some of these papers appeared in the *Sydney Daily Telegraph*, and from a large number of cuttings which Prof. Liversidge has sent us the following abstracts have been obtained.

PRESIDENT'S ADDRESS.

Prof. A. Liversidge, F.R.S., the Secretary and newly-elected President of the Association, delivered an inaugural address on the evening of January 6. The address was a survey of the objects and work of the Association, and a brief statement of the more important questions with which chemists have lately been concerned. The work of the International Catalogue of Scientific Literature was referred to, and the hope was expressed that Australasia would do something to assist the cataloguing of scientific publications. Reference was made to the fact that the Imperial Institute in London was becoming an institution for the advancement of science. It was now fulfilling its intended objects, and was becoming a most valuable means of disseminating a knowledge of the products and manufactures of the Indian Empire and the Colonies; not only of a commercial, but of a scientific value. Dealing with the chemistry of the ancients, Prof. Liversidge said they might include amongst the recent advancements of science the six important volumes recently published by Prof. Berthelot, of Paris (Perpetual Secretary of the Academy of Science and sometime Minister for Foreign Affairs). Referring to the report of the Committee appointed by the London County Council to inquire into the teaching of chemistry, Prof. Liversidge remarked that Australia at present imported most of its scientific men, but it was time it set about educating its own in greater numbers, and providing greater facilities and better equipped laboratories than the existing ones. The prosperity of a country very largely depended upon the advance of science amongst the people and the more or less practical application they made of each science. Students required to be taught not only the principles of science, but also how to observe, how to use their hands, and to reason and think accurately, and to gather their information from various sources; for there were but few, if any, text-books so well written as to be of equal value in all parts. And especially should they have time and opportunity for some original or research work, in order that they might enlarge the borders of knowledge, and contribute something, however small, to the common stock. Mere training and teaching for a degree was not sufficient; post-graduate work was essential if they wished to turn out scientific men, who would be able to advance Australia by developing its resources and improving the conditions of life. It was not sufficient to merely instruct in the facts and principles of scientific knowledge. It was most important also to impart scientific habits of thought and methods, especially with the object of making new investigations or researches, so that the student might in turn be able to teach something more than he himself was taught or learnt from books. With regard to recent work in chemistry, Prof. Liversidge referred to the discovery of argon and helium, and recent work on the liquefaction of gases. He also made brief references to the manufacture of artificial diamonds and other gems, the diffusion of metals, the phenomena of Röntgen radiation, agricultural chemistry, and other subjects of interest.

ASTRONOMY, MATHEMATICS AND PHYSICS.

Astronomy and Terrestrial Physics.

Mr. P. Baracchi (Government Astronomer of Victoria) selected the subject of "Astronomy and Terrestrial Physics" for his presidential address. He pointed out certain branches of astronomy and terrestrial physics which, in his opinion, had the strongest claim to the immediate consideration of the scientific workers of the Australasian Colonies, and in some cases to the encouragement and support of their Governments. After referring to the present observatories in Australia, Mr. Baracchi said it was very necessary for their observatories to be extremely careful with their available astronomical energy in order to turn it to the best possible account, and it should be employed solely in the preparation of data, which were demanded of them, as the most valuable contribution they could give to astronomy at the close of the present and commencement of the next century. Sidereal astronomy was well advanced in the Southern Hemisphere; indeed, it was said ten years ago that they were ahead of the Northern Hemisphere in point of exact star catalogues. In all other respects, however, their knowledge of the Southern Hemisphere was deficient. The course before them was clear.

Celestial photography, astronomy of position, and fundamental investigations for the improvement of both these branches should be the chief objects of their endeavours in the present and immediate future. Other branches of astronomical research must be left, and recommended to the amateur astronomers of the Colonies. The best service that could be rendered to astronomy by the amateurs would be to direct their efforts to a class or classes of observations which could not be made by observers in the Northern Hemisphere. With regard to terrestrial physics, there were certain subjects which derived their great importance not only from purely scientific considerations, but from their more or less direct bearing upon material interests, from the fact that in very recent years and at the present time they had been taken up with renewed vigour and determination in the hope of improving our knowledge on many points which still remained unexplained. Prominent amongst these was terrestrial magnetism, from a knowledge of which it was hoped would be gained a solution of some of the riddles which were now unexplained. It was recognised that the main question to which future efforts should be directed was to expand and coordinate magnetic work done all over the world for obtaining a more correct and complete knowledge of the distribution of terrestrial magnetism and of its variations. The establishment of an observatory in the interests of this science was a duty which New Zealand owed to the scientific world.

Cloud Heights and Velocity

A paper on "The Measurement of Cloud Heights and Velocity" was read by Mr. P. Baracchi. The year 1897 had been called by some writers on meteorological subjects "the cloud year," on account of the systematic observations of clouds which were carried on in nearly all the civilised countries during that period under a scheme laid out and finally agreed upon in all its detail by the International Meteorological Committee at its Upsala meeting in 1894. The object of the scheme was to obtain more uniform and comprehensive data to serve as the basis for the further study of atmospheric conditions, as indicated by the forms and movements of clouds. After a brief reference to the methods adopted in Victoria for securing results anticipated by the scheme, Mr. Baracchi said there were now some 20,000 observations ready. For the determination of absolute height and velocity a pair of stations for simultaneous observations were established, one being on the grounds of the Melbourne Observatory and the other on the roof of Parliament House at a distance of 6820 feet bearing. After consideration he adopted the photographic method, which had been successfully employed at the Kew Observatory some years ago. The absolute height and velocity of a cloud could, provided it was suitably situated, be determined from two photographs of it taken simultaneously with two cameras placed at a distance of from a few hundred yards to one or two miles from each other, the cameras being in all respects equal and rigidly mounted, so as to point accurately to their respective zenith, namely, having their collimation axes truly vertical. Under good conditions the highest clouds could be measured within 500 feet and the lower within 50 feet.

The Source of Periodic Waves.

Mr. H. C. Russell, F.R.S., Government Astronomer of New South Wales, read a paper on "The Source of the Periodic Waves, sometimes called Earthquake Waves, which reach Sydney from time to time." He stated that these waves were recorded very frequently in Sydney, and had the same period as the waves known to be caused by earthquakes—that was about twenty-six minutes from crest to crest; but it was shown that only about 1 per cent of them originated in earth movements, and that 60 per cent originated in Bass' Straits, when the meteorological condition known as a low pressure arrived at that part of Australia. The effect of low barometers was to cause a rise in the sea level, to provide for which currents set in along the south and east coasts of Australia, which, meeting in Bass' Straits, produced waves, and set them going in Tasman Sea, whence they were recorded on the Sydney and Newcastle tide gauges. It was also shown that at least another 10 per cent. of these waves originated in Tasman Sea by the action of heavy gales. That was, in all, 70 per cent. of the periodic waves originated from meteorological disturbances, and probably the remainder were due to these causes, although the connection was not proved.

tion had not yet been actually traced. Reference was made to Lake George, where somewhat similar periodic waves were frequent, and all were traced to meteorological causes.

Seismological Report.

In presenting the report of the Seismological Committee, the Secretary, Mr. George Hogben, of Timaru, New Zealand, referred to the work already done in his own Colony through the officers of the Telegraph Department, who, on the occurrence of any earthquake shock, filled up certain forms, stating the exact time and duration and such other details of the earthquake as might enable the seismologist to determine the origin of the disturbance, the velocity with which the waves were propagated through the earth's crust, and sometimes to make a very good guess as to the nature of the subterranean causes that gave rise to the earthquake. By means of these observations the sources of many of the earthquakes had been accurately found, their velocity of propagation determined, as in general rather under twenty miles a minute; in a few cases the depth of the origin was also ascertained, the deepest one found so far coming from a point about twenty-four miles below the earth's surface. This work had been done in New Zealand since 1889, and the other Colonies had been asked to follow suit. This they had done to a certain extent, but the Committee was anxious that the system should be developed, and made uniform throughout. Of recent work the most interesting item was probably the fact, based upon rough calculations from returns sent by Sir Charles Todd, and others, that the great South Australian earthquake of May 10, 1897, proceeded from a line parallel to the coast near Beachport and Kingston, and was possibly due to a sliding of one part of the crust upon another, such as forms what was called in geology a "fault." This was probably deep, but the later and slighter shocks were surface ones, caused by readjustments of the immediate crust. The subject was still under investigation by the Secretary. But Mr. Hogben pointed out that it was as part of a world-system of seismological observations that the work of the Committee might be most useful. An International Seismological Committee had been set up embracing all the ablest workers in every part of the world, and in co-operation with that Committee were Committees of the British Association and of the Royal Society. They desire especially to be able to track the microseismic vibrations of minute earthquake waves, which travelled from the sources of disturbance all round the earth's surface, or it might be right through the solid mass of our world (if it was solid). The speed of these finer waves was many times greater than that of the larger waves felt by us, reaching a velocity as great as twelve miles per second, or even more. For the purpose of observing them the International Committee had agreed upon a certain type of instrument, the horizontal pendulum to be used by all stations alike, as it was important that instruments of the same kind and of the same degree of sensitivity should be employed for purposes of comparison.

Mr. Hogben stated in answer to questions that, at the suggestion of Sir James Hector, the New Zealand Government had ordered two instruments—improved forms of the horizontal pendulum. He asked for the moral and financial support of the Association in this object. Unless instruments were procured at once for Sydney, Melbourne and Timaru (the three stations in Australasia named by the International Committee), the chain of world-stations would be interrupted.

CHEMISTRY.

Constitution of the Matter in the Universe.

The New South Wales Government Analyst, Mr. William M. Hamlet, delivered the presidential address in this section, the subject being "The molecular mechanism of an electrolyte." He defined an electrolyte as a body in solution or state of fusion, capable of being instantaneously decomposed by a current of electricity, and he claimed that if the explanation he offered was adequate for the electrolyte, it must hold good for the constitution of the matter in the universe, so that the treatise on the electrolyte has a most important scientific bearing. The method of investigating the action of one body upon another, he reminded his audience, was brought to a high degree of accuracy by the immortal work of Sir Isaac Newton. He alluded to some observations of the late Prof. Clifford, made over twenty years ago, this authority remarking, almost prophetically, "We can look forward to the time when the structure and motions in

the inside of a molecule will be so well known that some future Kant or Laplace will be able to make an hypothesis about the history and formation of matter."

Red Rain Dust.

Much interest was manifested in a paper read by Mr. Thomas Steel on "Red Rain Dust," in the section devoted to chemistry and chemical research. The author remarked that from time to time records of the fall of dust, either alone or accompanied by rain, have been reported from various parts of the Australian Colonies, in common with the rest of the world. Although it was extremely probable that in the great bulk of the cases the dust was merely of terrestrial origin, it was interesting when positive facts regarding the source of the material could be ascertained. On December 27, 1896, an unusually heavy fall of dust of a red colour occurred in Melbourne and was carried down by rain.

An analysis of a clean sample of this dust gave the following results:—Organic matter, 10.70; sand, insoluble and undetermined, 66.21; soluble silica, .75; ferric oxide, 4.68; ferrous oxide, .50; alumina, 15.16; lime, 1.36; sulphuric anhydride, .62. The dust may therefore be regarded as a characteristic example of ordinary surface soil, such as is derived from the weathering of volcanic rocks. Both in appearance and composition it agreed closely with several samples of such soil from widely separated localities. Under the microscope, in addition to the diatoms noticed by other observers, the dust was seen to contain a few lepidopterous scales.

GEOLOGY AND METEOROLOGY.

Early Life on the Earth.

In this section the President, Prof. F. W. Hutton, F.R.S., delivered an address on the subject of "Early Life on the Earth." After describing the various periods through which the earth has passed, Prof. Hutton presented some speculations regarding pre-Ordovician life. Speaking of the origin of life, he said it was highly probable that the first living organisms were evolved near the surface of a warm ocean. They might safely assume that the first protoplasm was not so complicated a substance as it had since become. Ordovician and Silurian life followed, and the lecturer said, in conclusion: "We have thus arrived at the conclusion that the ocean was the mother of life; that on its surface floated the first organisms whose descendants, but little changed during all the millions of years that have since passed away, still float and multiply. Presently some of these animals found their way down to the bottom, where all the débris from the floating organisms collected, and here in still water they lived and increased for a long time. Slowly they invaded the rough waters of the coastline, and at last gained a footing on the land. It was plants which formed the army of invasion that conquered the land."

Coral-boring Expedition to the South Seas.

Considerable interest was manifested in the section devoted to geology and mineralogy, owing to the fact that Prof. David was announced to read a paper on "The Coral-boring Expedition of 1897 to the Island of Funafuti in the South Seas." The funds for the expedition were found chiefly by Miss E. Walker, of Yaralla, the late Mr. Ralph Abercrombie, and the Royal Society of London, while the New South Wales Government lent a diamond drill and the workmen. The method of working the drill and simultaneously attacking the great coral cliff which bounds the atoll seawards was explained, and an account given of some of the manners and customs of the natives. Special reference was made to the nature of the last part of the boring done while Mr. Sweet was in charge. The last 30 feet of core were particularly interesting, being formed of a soft chalky rock, with numerous foraminifera, and showing that the coral formation proper had been all but completely penetrated. Had it been possible to bore a little deeper, Prof. David thinks that the foundation rock would have been reached. Mr. Sweet had done all that he judged would most conduce to attaining this end, and when the boring had to be stopped had left the bore in such a condition that it was possible in resuming the bore to utilise the old borehole, now 698 feet deep. Prof. David urged that this meeting might use its influence with the Council of the Association to have a recommendation made to the Government of New South Wales to extend the loan of the diamond drill so as to admit of the boring being continued till bedrock was

reached. A letter received from the Royal Society of London, stated that the Society was so pleased with the results already attained at the Funafuti bore, that it had voted a further sum to meet the expenses, making their total subscription up to the present 500*l*. Opinions amongst scientific men in Great Britain as to the conclusions to be drawn from the evidence of the Funafuti bore were at present divided. While the advocates of the Darwinian theory were inclined to congratulate themselves upon the results, Dr. Murray's supporters say that the evidence substantiates their views. Prof. David considered that the last portion of the core obtained weakened the subsidence theory.

Glacial Research.

The report of the Glacial Research Committee, South Australia, was submitted by Prof. T. W. E. David and Mr. Walter Howchin. The localities dealt with were comprised within the peninsula which formed the southern limits of the Mount Lofty Range. In 1859 Mr. Alfred Selwyn, at that time Government Geologist of Victoria, whilst travelling through the Inman Valley, discovered a polished rock surface which, to the practised eye, exhibited clear proof of glacial action. This was the earliest discovery of its kind in Australia, but the position was lost sight of until re-discovered by the authors of the paper in March last. This polished pavement, which measured over 20 feet in length and 6 feet in breadth, occurred in the bed of the Inman River, a little past the seventh mile-post from Port Victor. The glacial beds of the Inman River have at present an elevation of over 600 feet above sea level. If, therefore, the agency of shore-ice as the means of distribution were admitted they must assume that there had been an elevation of the land since the days of glaciation. The facts were, perhaps, best explained by a reference to a combination of agencies, rather than to a single form of ice action.

A paper "On the Occurrence of Glacial Boulders at Yellow Cliff, Crown Point Station, Fincke Valley, Central Australia," dealt with a recent discovery by Prof. Baldwin Spencer, of Melbourne University, and Mr. P. M. Byrne, of Alice Springs telegraph station, of large glaciated pebbles at a level of about 1000 feet above the sea. This is the nearest point to the tropics in Australia at which traces of glacial action have been observed, and the discovery is therefore of great interest. The pebbles are from 2 inches up to 1 foot in diameter, and form a layer about 3 feet in thickness, overlying a soft grey sandstone, the geological age of which is unknown. It is not known at what period of geological time the ice existed which produced these markings. The only other instance of possible evidence of ice action in Australia near to the equator than Yellow Cliff is that mentioned by Mr. R. L. Jack, viz. the Bowen River coalfield of Queensland. At that locality small boulders of rock foreign to the district are found embedded in the marine permo-carboniferous strata. It is just possible that these boulders were rafted to their present resting-place by floating trees, but the glacial explanation is thought to be the more probable one.

A paper entitled "Further Evidence of Glacial Action in the Bacchus Marsh District," by C. C. Brittlebank, G. Sweet, and Prof. David, dealt specially with the deep preglacial valleys bounded by steep sides, 500 to 600 feet high, which had been choked with glacial drift, and powerfully glaciated at their bottoms and sides, as well as on the summits of the intervening ridges. The fact was commented on that very few rocks of local origin were observable in the glacial beds, and that all the glacial beds were more or less stratified, in which respect they differed markedly from the glacial till of Northern Europe.

Geology and Mineral Deposits of Portions of West Australia.

The New South Wales Government Geologist (Mr. E. L. Pittman), read a paper "On the Geology and Mineral Deposits of certain portions of West Australia." The geology of the Perth artesian water basin was first dealt with, and it was stated that the water occurred in a porous rock, consisting of calcareous sandstone of æolian origin. The basin was about fifteen miles wide, but extended along the coast for several hundred miles in a north and south direction. The chief peculiarity of this artesian basin was that it was not covered by any continuous impervious beds, such as had hitherto been regarded as essential for the occurrence of artesian water. Reference was next made to the Collie coalfield, and the opinion was expressed by the author that it was of Mesozoic age, like the Victorian coalfields, and that of the Clarence River. The Coolgardie goldfield was

then briefly alluded to. The gold here occurred in some of the reefs in phenomenally rich "chutes," separated by intervals of barren material. The "cement deposits" of the 25-Mile were described as alluvial deposits, containing very angular gold, in fairly-defined channels. The Kalgoorlie goldfield was described at considerable length, and particular reference was made to the famous telluride deposits of the Boulder. These, in Mr. Pittman's opinion, consisted of igneous dykes of quartz, felspar, porphyry, which had been subjected to an enormous amount of crushing, and this had induced a schistose or foliated structure in them.

General Geology.

The Rev. J. Milne Curran read a paper on "Artesian Water in New South Wales." He concluded that the artesian water of the north-west and west of New South Wales was derived from Triassic beds, and, in his opinion, there was no evidence to show that a single artesian well in the Colony derived its waters from Cretaceous rocks. Photographs were exhibited of artesian flows, Cretaceous and Silurian country in the far west.

In the discussion that followed, Mr. R. L. Jack stated that artesian water had just been struck in Queensland, on the central line of railway at Maria Creek, west of the Dawson River, in rocks of permo-carboniferous age. These were the oldest rocks in Australia in which artesian water has as yet been discovered, and they were not known previously to be water-bearing.

The Rev. J. Milne Curran, in laying before members of the section some "Notes of a Geological Reconnaissance on the Mount Kosciusko Plateau," said that his conclusions were (1) that there was no satisfactory evidence of extensive glaciers having existed in the present valleys, under the highest peaks of Mount Kosciusko; (2) that there was no evidence of extensive glaciation on the Kosciusko plateau; (3) that the "glacial epoch of Australia" in post-Tertiary times, as described by Dr. Lendenfeld, had no foundation in fact.

BIOLOGY.

Relations of Morphology and Physiology.

The President of this section, Prof. C. J. Martin, dealt, in his opening address, with the growth of the science of morphology, which was now a separate science from physiology; the scope of research in both directions having, within the last fifty years, become greatly widened. Morphology deals with the structural conformation and anatomy of animals; physiology, with the functional workings of the animal system. During the last half-century the discoveries in both these sister sciences have been of a most beneficial character to mankind, and the future was full of possibilities. Prof. Martin did not let the occasion pass without bearing testimony to the ungrudging and valuable services of the late Prof. Jeffery Parker, during his term of the presidency of the section.

GEOGRAPHY.

Submarine Geography.

The President, Sir James Hector, K.C.M.G., F.R.S., in his presidential address, dealt at length with the subject of "Submarine Geography." Since their last meeting, Sir James said, the results of the exploring expeditions equipped by the munificence of the late Sir Thomas Elder and Mr. Horn had been made public, and the wonderful expansion of our knowledge of the central and western parts of the continent obtained through the intrepid journeys would greatly assist the material development of the vastly rich but hitherto neglected interior area of Westralia. Another feature of great promise to the future advance of geographical discovery in the more difficult parts of the Australian continent was the steady extension of the "artesian well" system into the arid areas of the interior, where the absence of water had not only prevented the settlement of the country, but even its exploration, and had caused the loss of many brave and enthusiastic pioneers under circumstances of intense personal suffering. When the sources of underground water circulation were fully comprehended and utilised, both exploration and occupation of large and almost unknown areas would become possible. After dealing with geographical researches conducted in different parts of the world, the President said the crowning event that had absorbed the interest of geographers since the last meeting was the successful achievement of Nansen. The scientific results of this wonderful venture had not yet been published, but two remarkable advances in geographical science

were announced: (1) that the North Polar Ocean was not a shallow sea, with scattered islands, distributing icebergs, but a profound ocean basin; (2) that there were definite movements of the great ice cakes, and that they crossed, and did not merely circulate round the pole.

Antarctica.

"Antarctica" was the subject of a lecture delivered by Sir James Hector, the president of the geographical section. The Antarctic Continent, or Antarctica, as it had been recently called, was an immense area of about 4,000,000 square miles; but they knew very little about it. There had been a number of expeditions to the North Pole, but very little had been done in the way of obtaining knowledge with regard to the South Pole. The last expedition by Nansen had proved that the North Polar region was a great cavity, nearly two miles deep, instead of being, as hitherto supposed, an island with half-open seas. The Antarctic regions, on the other hand, consisted of a great solid mass of land, extending far beyond the area explored by Nansen at the North Pole. Captain Cook, in 1776, furnished the first information with regard to the Antarctic regions; but it was not until Ross' expedition in 1841, followed by the *Challenger* in 1874, that any accurate information was obtained in regard to this continent. By means of his sounding apparatus, Ross made the discovery that there was a belt of water two miles in depth right round the Antarctic regions. In some places it showed a depth of 2000 fathoms, and in other places 4000 fathoms, without any bottom. Ross discovered Victoria Land, a mountain promontory stretching for 500 miles north and south, during which he passed through a belt of ice over 100 miles in width into calm, beautiful water beyond. Ross sailed south to latitude 78°, where he found volcanic mountains from 12,000 to 15,000 feet high, towering above a vast range of snowy mountains, and vomiting forth flames and lava. Huge glaciers descended for miles into the sea; but along the rocky shore no landing-place could be found, there being no harbour or indentation of any kind. A landing was, however, effected on Possession Island, which lay a short distance off the mainland. He attempted to reach the mainland from this island, but failed, and, turning eastward, he found a perpendicular wall of ice 200 feet high, and he traced it for 300 miles without a break. On some days the sun shone out with great brilliancy from a perfectly serene and clear sky of intense blue. Reference was made to the atmospheric conditions and currents of the Antarctic region, and then Sir James pointed out that within this circle no living thing had yet been found which belonged to the land. The life-history of the birds was most remarkable, because they could not breed within the Antarctic circle owing to there being no place for them to build their nests, except ice that was melting. In concluding, Sir James expressed the hope that the exploration of Antarctica would be continued. One of the most important things to be done in this direction was to settle the exact position and intensity of the magnetic pole, especially in the interests of navigation. Until they had established by survey the magnetic conditions of the southern end of the globe, careful and scientific provision could not be made for the safety of iron ships steaming upon different courses.

Australian Oceanography.

"A Contribution to Australian Oceanography" was the title of a paper by Mr. T. W. Fowler. The paper was suggested by the reports of the *Challenger* expedition, which seemed to leave room for much further investigation. An attempt had been made by the writer to get additional information, and with this end in view he had obtained from the captains or officers of various intercolonial steamships proceeding at regular intervals, samples of water passed through by them, together with the temperature of the sea at the time the sample was obtained. The samples were taken as near the vessels' bows as possible, and placed in well-cleaned bottles, which were tightly corked and forwarded to Mr. Walker for examination at the Melbourne University. Mr. Buchanan's method of conducting the examination was adopted. Two hydrometers were used, and the results were checked by testing the instruments in solutions of known densities. Tables were given showing the densities of waters obtained between Fremantle and Melbourne; between Melbourne and Brisbane; on the east coast of Australia generally; between Melbourne and the Bluff; on the Sorrento Back Beach, Bass Strait, and a number of other places.

Remarks on Central Australia.

"Notwithstanding the labours of the past, the last volume of Australian discovery is still incomplete," was the opening remark of the paper by Mr. W. H. Tietkins, who in 1889 led an expedition, which was fitted out under the auspices of the South Australian branch of the Royal Geographical Society, one of the objects of which was to determine the outline of Lake Asmodeus in Central Australia. Mr. Tietkins suggested that attention should be directed to the Rawlinson and Peterman Ranges, which lie to the north of the Mann and Tomkinson Ranges, and which were bounded on all sides by barren and inhospitable sandy wastes. To the best of his belief these ranges had not been visited, except by Giles, whose party was much reduced. These ranges formed an extensive and fertile field for systematic and scientific examination. It was suggested that a party might leave the settlements at Giles Range or Erldunda, and proceed from there to Mount Olga, where the first depôt would be formed, pending the discovery of suitable water being found further west and nearer the scene of operations. No difficulty would be experienced in reaching Sladen Water. It might be almost taken for granted that valuable waters would be found before reaching so far west. From the western end of the Rawlinson Range the party could return by a slightly different route, and if time and circumstances allowed before leaving Sladen Water. The conviction was forced upon him that no pasture lands of sufficient extent might be looked for that would develop the western interior, but the hope might reasonably be entertained that the mining industry in that latitude would challenge the enterprise of the Australian people.

ETHNOLOGY AND ANTHROPOLOGY.

The Origin of the Aborigines of Tasmania and Australia.

This was the subject chosen by Mr. A. W. Howitt, President of the ethnological and anthropological section, for his presidential address. He was of opinion that, in spite of the contention of many writers to the effect that the primitive Australians and Tasmanians had come from other lands in ships or canoes, there were but little evidences to show that they had any knowledge of navigation or of sea-going vessels. In any solution of the origin of the natives of Australia one fundamental element must be that the ancestors of these savages reached Australia or Tasmania by land; or if the land connection was not continuous, the intervening channels were such as could be traversed by vessels no better than the catamarans or canoes above mentioned. The lecturer quoted many geological facts, all of which tended to show that an immense period of time was one of the elements of any solution of the problem, and that during that period the Australians had been isolated from outside influence, having at the same time a continental area in which to develop their institutions. The level of culture of the Tasmanian had been termed the eolithic, and that of the Australians might fairly be termed neolithic, or even as regards some of the tribes of Central Australia bordering on the palaeolithic. The social organisation of the Tasmanians was also below the level of that of the Australians. Finally he came to the conclusion that the Australians reached the continent by a land bridge connecting with the Indo-Asiatic continent or by a land extension of the Austral continents to the north-west or over some shallow channels separating Australia from these lands.

A lecture on "Native Life in Central Australia" was delivered by Prof. W. Baldwin Spencer. After describing the difficulties of travelling, the lecturer remarked that the country was divided into the lower steppes, the desert country, and the higher steppes, where the James and Macdonell Ranges rear their lofty summits sometimes to a height of 5000 feet. Lake Amadeus in the dry season is a mere sheet of salt. Ayers Rock, another remarkable formation of this distant and mysterious land, rises abruptly from the surface of the desert country. It is about one mile long and five miles in circumference. Formerly there were vast rivers here, and animals, such as the diprotodon, a wombat-like creature about four times as large as a kangaroo, flourished on the plains. Now animal life was scarcely noticeable. The fish lived in the waterholes in the hills until the wet season came and washed them down the foaming gorges of the mountain to the lower lands. In the dry season the water-frog fills himself up with water, and, rolling himself into the mud, exists there until the next rains, which may not come for two years. In

the meantime the frog may have the misfortune to provide a drink for a thirsty native. The natives also obtain water from the roots of trees. They all believed that each one was under the ægis of the spirit of some animal or plant, which they revered almost as gods. In connection with the tokens, they held all sorts of weird ceremonies, bedecking themselves with great elaborateness, and going through all sorts of antics, such as imitating frogs, emus, kangaroos, or whatever it was they held in veneration. Group marriage prevails; that is, men in one group can only marry the women in another single group. The Engwurra, or the fire ceremony, through which a youth has to pass before being entitled to be considered a man, seems to be peculiarly exacting to the candidate for manhood.

RESOLUTIONS OF COUNCIL.

At the final meeting of the General Council on January 13, the following suggestions from the Recommendation Committee were agreed to:—(1) That the New South Wales Government acquire the quarry of prismatic sandstone at Bondi, with a view to its preservation as a remarkable geological occurrence. (2) The re-appointment of the Committee on "The Systematic Conduct of the Photographic Work of Geological Surveys." (3) The appointment of a Seismological Committee for 1900. The Government of New Zealand to equip Timaru with approved seismological instruments, in charge of Mr. George Hogben. A contribution of 25% was voted towards the preceding object. (4) The appointment of a Committee to secure magnetic surveys at the extreme south of New Zealand. (5) Expressing the opinion that the publication of Victorian continuous magnetic records is desirable. (6) That the Committee be re-appointed to continue the investigation of the mineral waters of Australasia. (7) That the New South Wales Government be recommended to complete the borings at Funafuti while the bore apparatus remains on the island, and the bore remains open. (8) A Committee be appointed to draw up a list of works and papers relating to Australian flora.

The report from the Baron von Mueller Memorial Committee, embodying a resolution, "That the Association places on record its sense of the deep loss sustained by it owing to the death of the late Baron von Mueller, and its high appreciation both of his personal character and the distinguished services rendered by him to science," was adopted.

On the motion of Prof. Kernot, of Melbourne, seconded by Prof. Baldwin Spencer, Mr. R. L. J. Ellery, late Government Astronomer of Victoria, was elected to be President of the Science Congress to be held in Melbourne in the year 1900. Mr. C. R. Blackett, Government Analyst of Victoria, was elected treasurer, and Prof. Baldwin Spencer and Mr. E. F. J. Love were elected joint secretaries for the same Congress. It was decided that the next meeting of the Association after the one to be held in Melbourne will take place at Hobart.

FORTHCOMING BOOKS OF SCIENCE.

IN Messrs. Baillière, Tindall, and Cox's list are to be found:—*"A Manual of Surgery,"* by Drs. William Rose and Albert Carless; *"Atlas of Traumatic Fractures and Dislocations,"* by Prof. H. Helferich (vol. vi. "Hand-Atlas" Series); *"English-French and French-English Dictionary of Medical Terms,"* by H. de Méric, two parts; *"Minor Surgery and Bandaging,"* by Dr. W. G. Spencer, illustrated; *"Respiratory Exercises,"* by Dr. Harry Campbell; *"Diagnostic Signs in Women,"* by Dr. T. W. Eden; *"The Clinical Diagnosis of Lameness in the Horse,"* by W. E. A. Wyman, illustrated; *"Practical Toxicology for Physicians and Students,"* by Prof. Dr. Kobert, translated and edited by Dr. L. H. Friedberg; *"Chronic Nasal Obstruction, and Deformities of the Upper Jaw, Teeth, and Palate,"* by Dr. Mayo Collier; *"Atlas of Pathological Anatomy,"* by Prof. O. Bollinger (vol. vii. "Hand-Atlas" Series), illustrated; *"Idiopathic Ulcerative Colitis (Dysentery),"* by J. F. Gemmel, illustrated; *"Water" (Part ii. of the "Analysis of Food and Drugs"),* by T. H. Pearmain and C. G. Moor; and new editions of *"A Guide to the Examinations of the Conjoint Board in England and for the Fellowship of the College of Surgeons, with Examination Papers,"* by F. J. Gant; *"Heart Disease, with special reference to Prognosis and Treatment,"* by Sir William Broadbent, Bart., and Dr. J. F. H. Broadbent; *"Diseases of the Throat and Nose,"* by Lennox Brown, illustrated; *"Applied Bacteriology,"* by T. H. Pear-

main and C. G. Moor; *"The Practical Guide to the Public Health Acts and Correlated Acts for Officers of Health and Inspectors of Nuisances,"* by Dr. Thomas Whiteside Hime; *"Latin Grammar of Pharmacy,"* by Joseph Ince; *"A Manual of Artistic Anatomy for the Use of Students in Art,"* by John C. L. Sparkes, with plates; *"Handbook for Attendants on the Insane,"*; *"The Register of the Royal College of Veterinary Surgeons."*

Messrs. Wm. Blackwood and Sons' list includes:—*"A Text-book of Modern Geometry,"* by J. A. Third; *"Lower Geometrical Exercises,"* by the same author; *"Higher Geometrical Exercises,"* by the same author; *"The Elements of Physical Education, a Teacher's Manual,"* by Dr. David Lennox and Alexander Sturrock, with Original Musical Accompaniments to the Drill by Harry Everitt Loseby, illustrated; *"A Manual of Agricultural Botany,"* from the German of Dr. A. B. Frank, translated by Dr. John W. Paterson, illustrated; and new editions of Sir John Skelton's *"The Handbook of Public Health,"* revised by James Patten MacDougall and Abijah Murray, Part ii. containing other Acts bearing on Public Health, with Notes, Forms, &c.; *"Introductory Text-book of Zoology,"* by Prof. Henry Alleyne Nicholson, F.R.S., and Dr. Alexander Brown, illustrated; *"Page's Introductory Text-book of Geology,"* revised and enlarged by Prof. Lapworth, F.R.S.; *"Page's Advanced Text-book of Geology,"* Descriptive and Industrial, with engravings, and Glossary of Scientific Terms, revised and enlarged by Prof. Lapworth, F.R.S.; *"Introductory Text-book of Meteorology,"* by Dr. Alexander Buchan, illustrated; *"Dr. Mackay's Elements of Physiography,"* illustrated.

Messrs. Bliss, Sands, and Co. announce:—The Progressive Science Series: *"Earth Structure,"* by Prof. Geikie, F.R.S., illustrated; *"Volcanoes,"* by Prof. Bonney, F.R.S., illustrated; *"The Groundwork of Science,"* by Dr. St. George Mivart, F.R.S.; *"Vertebrate Palæontology,"* by Prof. Cope, illustrated; *"Science and Ethics,"* by M. Berthelot; *"The Animal Ovum,"* by F. E. Beddard, F.R.S., illustrated; *"The Reproduction of Living Beings: a Comparative Study,"* by Prof. Marcus Hartog, illustrated; *"The Study of Man: an Introduction to Ethnology,"* by Prof. A. C. Haddon, illustrated; *"Man and the Higher Apes,"* by Dr. Keith, illustrated; *"Heredity,"* by J. Arthur Thomson, illustrated.

Messrs. Burns and Oates, Ltd., promise:—*"Genesis and Science,"* by John Smyth.

The list of the Cambridge University Press includes:—Cambridge Natural Science Manuals, *Biological Series*: *"Fossil Plants, a Manual for Students of Botany and Geology,"* by A. C. Seward; *"Vertebrate Palæontology,"* by A. S. Woodward.

Messrs. Cassell and Co., Ltd., announce:—The "Century Science" Series: *"Michael Faraday, his Life and Work,"* by Prof. Silvanus P. Thompson, F.R.S.; *"Cassell's Family Doctor,"* by a Medical Man; and new editions of *"The Story of Our Planet,"* by Prof. Bonney, F.R.S., with coloured plates and maps, and illustrated; *"The Story of Africa and its Explorers,"* by Dr. Robert Brown, 4 vols., illustrated; *"The Countries of the World,"* by Dr. Robert Brown, vol. v., illustrated.

Messrs. Chapman and Hall, Ltd., will issue:—*"Physics, Experimental and Theoretical: an Elementary Treatise Mechanics, Hydrostatics, Pneumatics, Heat and Acoustics,"* by Dr. R. H. Jude and H. Gossin, illustrated; *"The Manufacture of Boots and Shoes,"* being a modern treatise of all the processes of making and manufacturing footgear, by F. Y. Golding, illustrated; *"Notes on Carpentry and Joinery,"* adapted to the requirements of the City and Guilds of London Institute, the Worshipful Company of Carpenters, and the County Council's Scholarship Examinations, by J. T. Evans; *"Second Stage, Ordinary or Advanced Course, illustrated; "Chinese Porcelain,"* by W. E. Gulland, illustrated; *"De Pontibus, a Pocket-book for Bridge Engineers,"* by J. A. L. Waddell; *"Machine Design,"* Part i. *"Kinematics of Machinery,"* by Prof. Forrest R. Jones; *"Handbook of Street-Railroad Location,"* by Prof. John P. Brooks; a new edition of *"A Text-Book of Mechanical Engineering,"* by W. J. Lineham, illustrated.

Messrs. Chatto and Windus promise new editions of: *"Flammariion's Popular Astronomy,"* translated and edited by J. Ellard Gore, illustrated; *"Popular Astronomy,"* by J. Rambosom, translated by C. B. Pitman, illustrated.

Messrs. J. and A. Churchill will publish:—*"Manual of General Pathology for Students and Practitioners,"* by Dr.